MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

TSN2101 – OPERATING SYSTEMS

(All Sections /Groups)

14 OCTOBER 2019
9.00 a.m. - 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question Paper consists of 5 pages with 4 Questions only.

2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please print all your answers in the Answer Booklet provided.

QUESTION 1

a) What is the difference between system call and system program?

[3 marks]

b) Why is standard API normally used instead of system call?

[2 marks]

c) Draw a diagram and list down the difference between a single-threaded process and a multi-threaded process. Your diagram should include all the relevant components in a process.

[3 marks]

d) In the state process diagram, processes may occupy a variety of states. Assuming a process is in ready state, due to some I/O operations, the process goes to waiting state. Please explain why this statement is wrong.

[3 marks]

e) Assuming a process is currently in waiting state. Explain how this process goes to terminated state according to the state process diagram (with assumption the process is not forcibly terminated by the system administrator).

[4 marks]

QUESTION 2

a) Consider the following set of processes:

Process	Arrival time	Burst-time	Priority
P1	3	5	3
P2	1	6	1
P3	0	2	2
P4	2	1	4
P5	4	5	5

i) Draw the Gantt charts illustrating the execution of these processes using **Pre-emptive Priority** (a smaller priority number implies a higher priority), and **Round Robin (RR) (quantum = 3)** scheduling.

[2 + 2 = 4 marks]

ii) Calculate the average turnaround times for the **Pre-emptive Priority and RR algorithms**?

[1 mark]

iii) What are the average waiting times for the **Pre-emptive Priority and RR algorithm**?

[1 mark]

Continued...

b) What three conditions must be satisfied in order to solve the critical section problem?

[3 marks]

c) Consider the following system with FIVE processes and THREE resource types:

- A has 10 instances
- B has 10 instances
- C has 10 instances

The snapshot of the system is given as:

Process	Allocation A B C	Max A B C
P1	1 3 2	7 10 7
P2	1 4 2	2 4 5
P3	4 0 2	5 5 5
P4	1 1 0	6 7 6
P5	1 1 1	5 2 4

Available A B C
2 1 3

Answer the following questions using the **Banker's algorithm:**

i) What is the content of the matrix *Need*?

[2.5 marks]

ii) Find a sequence of processes that will get the system into a safe state, if there is any. Show all required steps.

[3.5 marks]

QUESTION 3

a) If reference to the TLB takes 25 nanoseconds, and memory reference takes 100 nanoseconds, identify the hit ratio to achieve an effective access time of 150 nanoseconds.

[2 marks]

b) Consider the following segment table:

Segment	Base	Length
0	100	250
1	2000	75
2	400	25
3	800	150

Continued...

Check whether the following logical addresses results in addressing error and trap to operating system. If it does not result in addressing error, identify the corresponding physical address.

i) 1, 560
ii) 0, 5
iii) 2, 1
iv) 3, 200

[0.5 + 0.5 + 0.5 + 0.5 = 2 marks]

c) Consider a system that uses a three-level page table with page size of 1 KB and 32-bit logical addresses. The first 8 bits of the address serve as the index into the first-level page table, and the last 8 bits serve as the index into the third-level page table.

i) How many bits are needed to specify the second-level index?
ii) How many entries are in a level-one page table?
iii) How many entries are in a level-two page table?
iv) How many pages are in the virtual address space?

[0.5 + 0.5 + 0.5 + 0.5 = 2 marks]

d) When the same files need to be accessed in more than one place in the directory structure, an acyclic-graph structure can be used, such as a symbolic link. Suggest what can be done to the symbolic links if the original file is moved or deleted.

[3 marks]

e) Suppose that a disk drive has 2000 cylinders, numbered from 0 to 1999. The drive is currently serving a request at cylinder 500, and the previous request was at cylinder 650. The queue of pending requests, in FIFO order, is

75, 1250, 925, 1650, 1025, 1225, 1425, 1750, 250

Starting from the current head position, what is the **schedule** and the **total distance** that the disk arm moves to satisfy all the pending requests, for each of the following disk-scheduling algorithms?

- FCFS
- LOOK

[3 + 3 = 6 marks]

Continued...

QUESTION 4

a) Consider the following page reference string:

6 5 7 8 5 6 7 8 8 6

Assume the availability of **THREE** frames and all the frames are initially empty. Consider the **First-In-First Out (FIFO), Least Recently Used (LRU)** and **Optimal (OPT)** page replacement algorithms for Virtual-memory management.

- Identify the number of page faults that would occur if FIFO is used.
- Identify the number of page faults that would occur if LRU is used.
- Identify the number of page faults that would occur if OPT is used.

Show **all steps** involved.

[2 + 2 + 2 = 6 marks]

b) Assume the following table for the system with **Eight Page Frames.**

Page number	Load Time	Last Reference Time	Modify Bit	Reference bit
0	30	75	0	1
1	25	100	1	1
2	100	130	0	1
3	5	100	1	1
4	15	200	1	0
5	20	205	1	1
6	120	35	0	1
7	10	105	1	1
8	15	150	0	1

Identify the victim (page to be replaced) for the following algorithms. Give the reason for your selection.

i) First-In-First-Out (FIFO)
ii) Least-Recently-Used (LRU)
iii) Reference bit – Modify bit combination (Assume modify bit is having higher priority over reference bit and FIFO is used in the case of tie)
iv) Second Chance

[1 + 1 + 1 + 1 = 4 marks]

Continued...

c) Using contiguous allocation to store files on disk, several problems can arise when files grow, or if the exact size of the file is unknown. Explain THREE of these problems.

[3 marks]

d) In Linux, three level paging is used in memory management, where a linear address is broken into FOUR parts. List these parts.

[2 marks]

End of Page.